Humeral Nonunions: Issues and Strategies?

Cory Collinge, MD
Vanderbilt University
Nashville, TN

Disclosure
Consultant
• Biomet
• Smith and Nephew
Royalties
• Biomet
• Smith & Nephew
• Advanced Orthopedic Systems

Humeral Shaft Fractures
• Healed and well-aligned
  “UNION”
  97%
Humeral Shaft Fractures

- Unhealed and well-aligned
- Healed and poorly-aligned
- Unhealed and poorly aligned

“NONUNION (or MALUNION”) 3%

Humeral Shaft Nonunions

Infection

Biology

Mechanics

Humeral Shaft Nonunions

- Nonunion is predictable in some
  - Limb
    - Proximal 1/3
    - Open fracture
    - High-energy
    - Comminution/bone loss
    - Infection
  - Host
    - Diabetes
    - Nicotine
    - NSAIDs
    - Thyroid
    - Immune disorders
    - Testosterone
    - Vitamin D
    - Cancer drugs
Humeral Shaft Nonunions

Patients
• The D’s
• Disabled
• Depressed
• Destitute

If you help them they are *Darn thankful!*

---

Humeral Shaft Nonunions

Treatment
• Challenging problems
• Thoughtful intervention
• No cookbook answers
• Creative solutions

A number of generalizations exist which will help you provide a customized Rx plan

---

Humeral Shaft Nonunions

A thoughtful approach....
• Host
• Bone
• Soft tissues
• Alignment
• Infection
Humeral Shaft Nonunions

• General Approach
  – Why is it not healed?
    • Host problems - correctable?
    • Limb problems - correctable?
  – Is it infected?
  – How long will fracture stability be maintained?

Humeral Shaft Nonunions

Host problems: Correctable?
  – A long list......
    • Nicotine
    • NSAIDs
    • Thyroid
    • Testosterone
    • Vitamin D
    • Diabetes
    • Hepatitis
    • Immune disorders
    • Cancer drugs
  • If so, WE SHOULD CORRECT THEM!

Humeral Shaft Nonunions

Atrophic (oligo or hypo-trophic)
• Lack of callus (healing)
• “Avascular”
• Failure of healing cascade
• Factors
  – Host
  – Limb
Solution: BIOLOGIC!
Humeral Shaft Nonunions

**Atrophic (oligo or hypo-trophic)**
- Lack of callus (healing)
- “Avascular”
- Failure of healing cascade
- Factors
  - Host
  - Limb

Solution: **BIOLOGIC!**

Humeral Shaft Nonunions

**Hyper-trophic nonunions**
- Lots of callus
- “Vascular”
- Mechanically unstable
- Factors
  - Rx failure?

Solution: **MECHANICAL STABILIZATION!**

Humeral Shaft Nonunions

**Infection must be “ruled out”**
- History
- Examination
- Sedimentation rate, C-reactive protein
- Nuclear medicine
- MRI (CT)
- Culture
- Pathology
Infection must be “treated”

- Debridement
- IV ABX
- Local ABX
- Wound coverage (Plastics)
- (Suppressive ABX)

Will defer to afternoon talk

Humeral Shaft Nonunions

<table>
<thead>
<tr>
<th>Fixation</th>
<th>(+)</th>
<th>(-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• IM nail</td>
<td></td>
<td>Retained implant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shoulder pain</td>
</tr>
<tr>
<td>• Plates/ screws</td>
<td></td>
<td>Retained implant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Larger dissection</td>
</tr>
<tr>
<td>• External fixation</td>
<td></td>
<td>Less familiar</td>
</tr>
<tr>
<td></td>
<td>Less dissection</td>
<td>Additional surgeries</td>
</tr>
<tr>
<td></td>
<td>No retained implant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexibility of usage</td>
<td></td>
</tr>
</tbody>
</table>

A Few Cases
Case 1: History

- 68 yo woman
- BMI 38
- 2 years from fracture
- Nailed 3 mos later
- Shoulder pain 2/10
- Mid arm pain 4/10

Case 1: History

- 58 yo woman
- BMI 38
- 2 years from fracture
- Nailed 3 mos later
- Shoulder pain 2/10
- Mid arm pain 4/10

Case 1: History

- Nicotine?
- Medical Hx?
  - Thyroid
  - Hormones
  - Vit D
  - Osteoporosis
  - Prior NU
- Medications?
  - Chemo
  - Psychotropics
  - Seizure
  - Osteoporosis
Case 1: History

- Nicotine?
- Medical Hx?
  - Thyroid
  - Hormones
  - Vit D
  - Osteoporosis
  - Prior NU
- Medications?
  - Chemo
  - Psychotropics
  - Seizure
  - Osteoporosis

Low Vit D
Osteopenia

---

Case 1: History

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills

---

Case 1: History

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills

Infection risk is low

---
Case 1: Tests

- Basic anesthesia labs
- CBC
- C-reactive protein
- Sed rate
- Thyroid
- PTH
- Vit D
- Hormones

Case 1: Summary

- Bone metabolism?
- Low probability infection?

Start surgical planning

- Treat Vit D
- Await labs
- Await labs

Case 1: Surgery

- Address hardware
- Fixation construct
- “Graft”
- Approach
- Set-up
Debride & Fixation Construct

- Remove nail
- AL approach
- Freshen bone ends/NU
- Deep culture
- Fibular allograft
- Long 4.5mm plate
- Compression applied
- Autograft (Gerdy’s)

Anterolateral Approach

Radial Nerve Protection

- Tale of 2 outcomes
Follow-up

Case 2

- 48 yo woman
- BMI 37
- Polytrauma
- 9 mos from fracture
- Mid arm pain 4/10

Case 2: History

- Nicotine?
- Medical Hx?
  - Thyroid
  - Hormones
  - Vit D
  - Osteoporosis
  - Prior NU
- Medications?
  - Chemo
  - Psychotropics
  - Seizure
  - Osteoporosis

Low Vit D
Hypothyroid
Distal femur NU
Case 2: History

- # surgeries
- Infection Hx
- Persistent drainage
- Wound problems
- Given ABX
- Fevers/chills

Infection risk is low

Case 2: Tests

- Basic anesthesia labs
  - CBC
  - C-reactive protein
  - Sed rate
  - Thyroid
  - PTH
  - Vit D
  - Hormones

Vit D risk is low
TSH is low
Endocrine consult

Case 2: Surgery

- Address hardware
- Fixation construct
- No “Graft”?
- Approach
- Set-up
Debride & Fixation Construct

- Posterior Approach
- Remove plate
- Examine bone > Cx
- Long 4.5mm plate
- Compression applied

Posterior Approach

Triceps splitting

Triceps sparing
Locked Plating

• Fixed angle device
• Lots of screws
• Open approach

Case 2: Follow-up

8 months

Humeral Shaft Nonunions

Treatment
• Challenging problems
• Thoughtful intervention
• No cookbook answers

A number of generalizations exist which will help you provide a customized Rx plan
Thank You